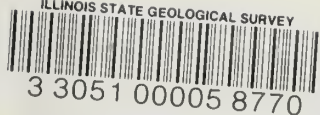



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July 1965



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LIMESTONE RESOURCES OF JEFFERSON AND MARION COUNTIES, ILLINOIS

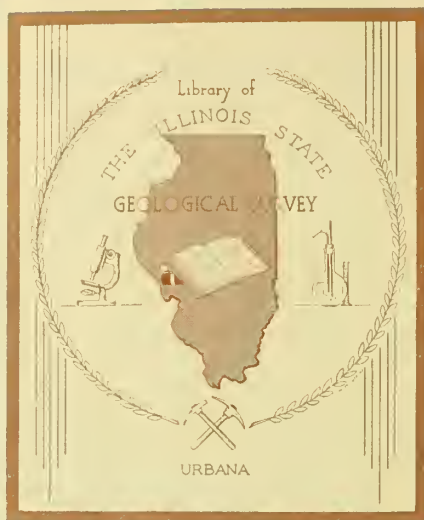
James C. Bradbury

A B S T R A C T

Jefferson and Marion Counties, in central southern Illinois, are underlain at shallow depth by shales and sandstones and a few comparatively thin limestones of Pennsylvanian age. Because the limestone strata afford the only source of stone in the area for agricultural limestone, roads, and other purposes, some of them are of present or potential importance even though they are thin. This report describes the limestone outcrops and traces their probable distribution. Outcrop data were supplemented by drilling information wherever it was available.

One member of the Mattoon Formation, the Dix Limestone, is named and described and its type section is designated.

Maps show the locations and geologic names of outcropping limestones and a tentative outcrop line of the Omega Limestone, the thickest such unit found in the two counties. Chemical analyses of samples from all limestone outcrops 2 feet or more thick are given. Suggestions are made for prospecting for the Omega and three other limestones that locally become comparatively thick.



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LIMESTONE RESOURCES OF JEFFERSON AND MARION COUNTIES, ILLINOIS

INTRODUCTION

Jefferson and Marion Counties, located in central southern Illinois (fig. 1), are underlain by strata of Pennsylvanian age that consist chiefly of shale and sandstone and a few comparatively thin limestones. As limestone outcrops are not numerous, an investigation was conducted to locate and describe those more than a foot thick, to determine the composition of the thicker limestones, and to suggest areas for prospecting for limestone deposits.

Most of the data in the report result from studies of outcrops and whatever subsurface information was available from borings. However, as most of the borings were made for oil and the drilling records describe the near-surface formations in only a very general way, they supply little specific information on shallow limestones. Electric logs, which commonly begin at a minimum depth of 100 feet, were used to detect limestones below that depth. Elevations of limestones shallower than 100 feet were calculated from such data by adding a known or assumed thickness interval to the elevation of the limestone in the electric log. Thus a tentative outcrop line for a specific limestone was laid out and used as a field guide in the search for actual outcrops.

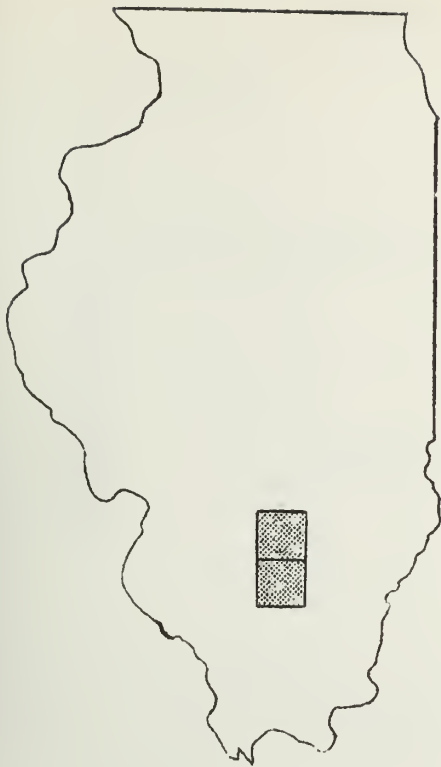
Difficulties inherent in tracing and checking outcrop lines of limestones in the field were the scarcity of outcrops due to a covering of glacial drift and the lack of pronounced relief, and the tendency of the Pennsylvanian limestones to thin laterally. Consequently, the absence of an outcrop of a specific limestone at a projected location could mean that the limestone was present but covered, that it had thinned to zero thickness, or that the projection was in error.

Samples for chemical analysis were taken at all exposures of 2 feet or more thick. Samples for physical testing were taken at the Belle Rive Mining Company quarry near Dix and the Shoots quarry near Omega.

PRESENT QUARRYING INDUSTRY

Three quarries are active in the area at present:

Belle Rive Mining Company Quarry, NW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 26,
T. 1 S., R. 2 E., Jefferson County. Near Dix. Rock
quarried is the Dix Limestone.



Randall Stone Quarry, NE $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 26, T. 1 S., R. 2 E., Jefferson County. Near Dix. Rock quarried is the Dix Limestone.

Shoots Quarry, NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 25, T. 3 N., R. 3 E., Marion County. Near Omega. Rock quarried is the Omega Limestone.

DESCRIPTION OF EXPOSED STRATA

The bedrock in Jefferson and Marion Counties is of Pennsylvanian age, chiefly shale and sandstone; relatively thin limestones occur at irregular intervals. Most of the limestones are impure and thin, commonly about 1 foot thick. Two of them, however, the Dix Limestone and the Omega Limestone are quarried in the area and appear to offer the best possibilities for further development. The Shoal Creek Limestone is quarried near Radom in Washington County about 4 miles west of the Jefferson County line and may be present locally at relatively shallow

Fig. 1 - Location of Jefferson and Marion Counties.

depths in extreme western Jefferson and Marion Counties.

Shoal Creek Limestone

The Shoal Creek Limestone is the basal member of the Bond Formation (fig. 2). It is not exposed in Jefferson and Marion Counties but crops out in Perry County a quarter of a mile west of the Jefferson-Perry County line along the east bank of the Little Muddy River, 6 miles southwest of Waltonville (fig. 3). There the Shoal Creek is a hard, grayish brown, sublithographic limestone. Analysis (table 1, sample JM-2) shows it to be moderately pure and slightly dolomitic. Although only a 3-foot thick ledge is now exposed, Engelmann (1868) observed a 5-foot thickness at this location. Drilling data in the two counties indicate a thickness of 4 to about 10 feet for the Shoal Creek in the subsurface, with 5 to 6 feet as the usual figure. A description is given in the appendix, site JM-2.

Limestones Between Shoal Creek and Millersville Limestone Members

Limestones within the Bond Formation between the Shoal Creek and Millersville Limestone Members are exposed in southwestern Jefferson County (fig. 3). Outcrops were examined at three different locations (table 2), sections 5, 7, and 16, T. 3 S., R. 1 E. Two of the limestone units were dark colored, very fossiliferous, and tended to weather thin bedded and shaly. The third, a 6-inch bed, was brownish gray, fine grained, and dense. None of the limestone units observed were more than 1 $\frac{1}{2}$ feet thick.

MEMBERS

Millersville Limestone Member

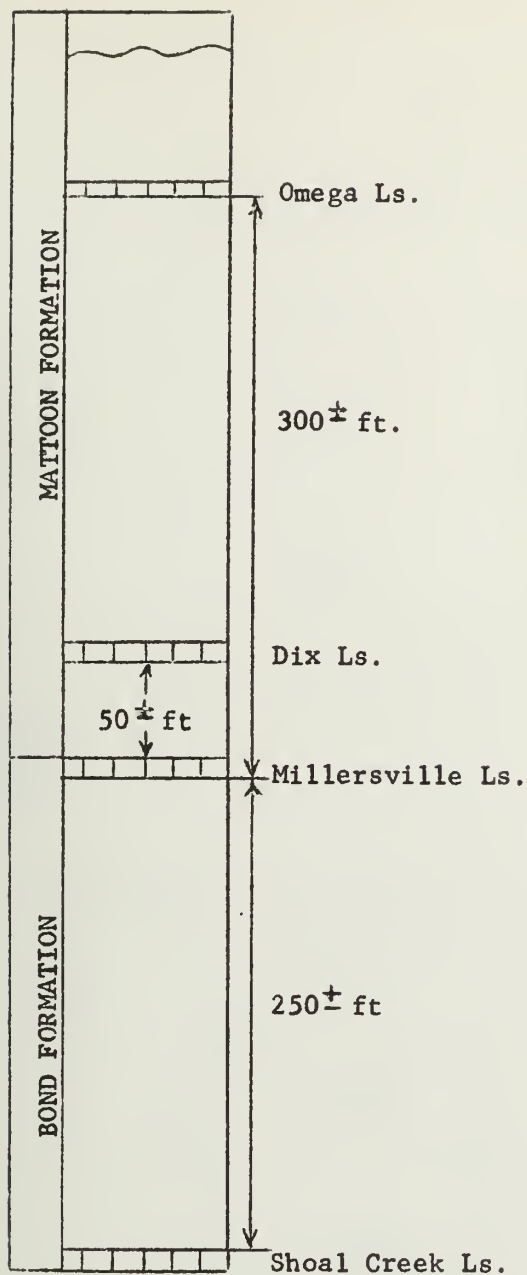


Fig. 2- Relative stratigraphic positions of principal Pennsylvanian Limestones in Jefferson and Marion Counties.

The Millersville Limestone, the top member of the Bond Formation (fig. 2), is exposed at several places in western Jefferson and Marion Counties (fig. 3). It is extremely variable in both lithology and thickness and apparently includes more than one limestone bed in a shale-limestone sequence. Where observed in Jefferson and Marion Counties, the limestones are generally dark colored and fine grained and contain various amounts of silt. Three outcrops, all in Marion County, were found to be sufficiently thick to warrant being sampled for chemical analysis (fig. 3, table 1, and appendix, samples JM-6, JM-7, JM-8). Two of them, JM-6 and JM-7, represent two beds about 10 feet apart within the Millersville. All three outcrops contain relatively large amounts of silica, presumably as silt-size quartz, and JM-7 is a calcareous siltstone.

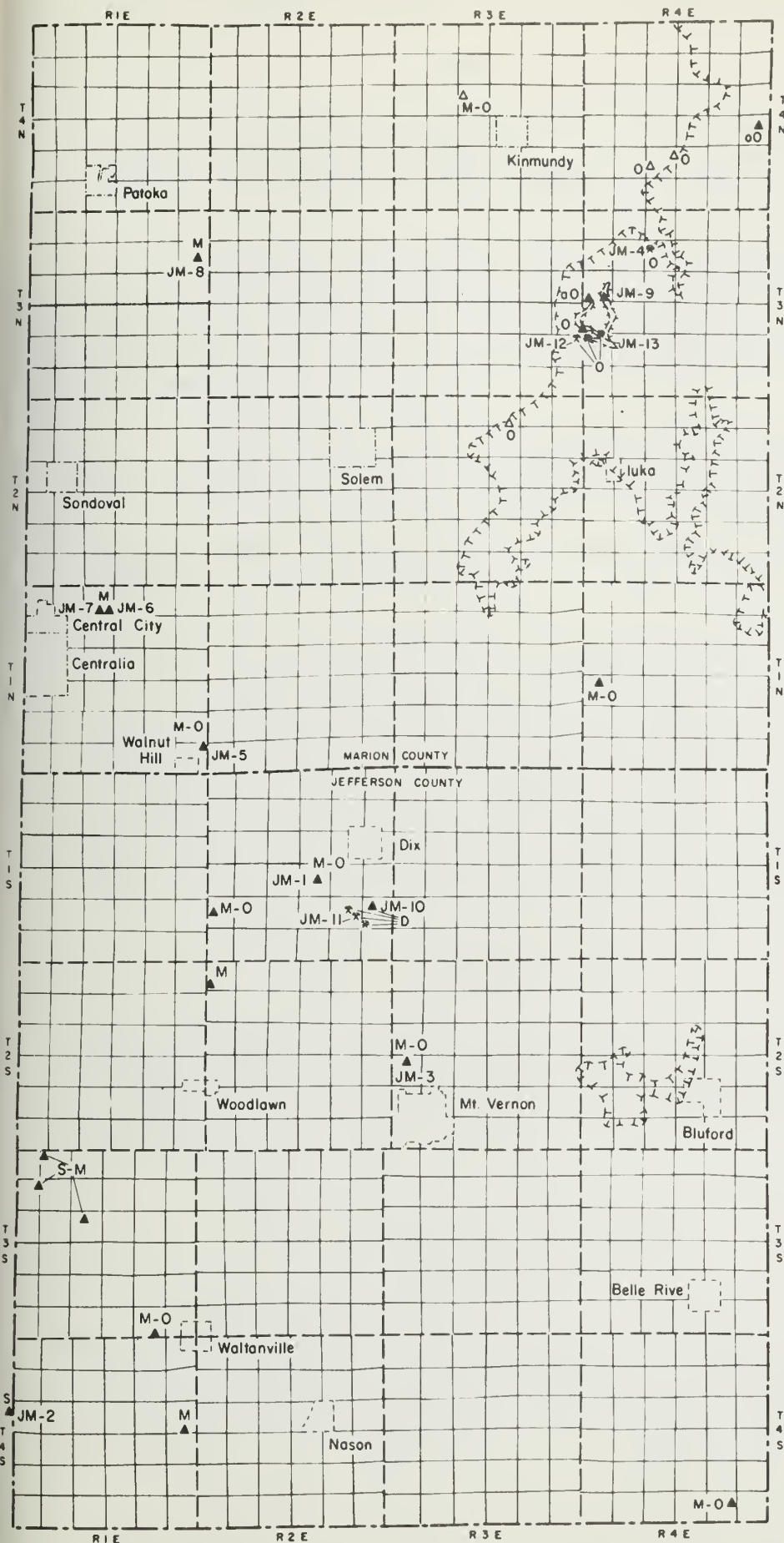
The sampled outcrops are described in the appendix. Other outcrops are listed in table 2.

Limestones Between
Millersville and Omega
Limestone Members

Limestone members in the Mattoon Formation below the Omega Limestone Member are exposed at several places in Jefferson County and at two places in Marion County (fig. 3). Their characteristics range from very thin to heavy bedded, dark to light colored, and impure to moderately pure. Thicknesses vary from less than 1 foot to at least 6 feet.

Dix Limestone

The thickest of these members lies about 50 feet above the Millersville Limestone (fig. 2) and is exposed in three quarries and an outcrop, JM-10, 1½ to 2 miles south of Dix (fig. 3). The name Dix Limestone Member is here given to this unit of the Mattoon Formation, and outcrop JM-10 in the NW¼ SE¼ NW¼ sec. 25, T. 1 S., R. 2 E., is designated the type section.



EXPLANATION

- * Quarry, active
- * Quarry, abandoned
- ▲ Limestone outcrop
- △ Limestone float blocks
- oO Limestone above Omega Ls
- O Omega Ls
- D Dix Ls
- M-O Unnamed limestones between Millersville and Omega Ls
- M Millersville Ls
- S-M Limestones between Shool Creek and Millersville Ls
- S Shool Creek Ls
- JM-4 Sample site
- (Tentative line) Tentative outcrop line of Omega Ls calculated from drilling data



Fig. 3 - Location of limestone outcrops and calculated position of Omega Limestone Member of Mottoon Formation, Marion and Jefferson Counties

Sampled outcrops are described in the appendix, and their chemical analyses are shown in table 1. Other outcrops are listed in table 2.

Omega Limestone Member

The Omega Limestone Member of the Mattoon Formation is exposed in eastern Marion County, chiefly in a relatively small area between Iuka and Kinmundy in which there are one operating and several abandoned quarries (fig. 3). No outcrops of this limestone are known in Jefferson County.

The Omega, where seen in outcrop, is generally a hard, gray to brownish gray, fine-grained limestone, in places very fossiliferous. Locally, it may be represented by a conglomerate of limestone pebbles in a sandy or silty matrix. Observed thicknesses range from 3 feet to 11 feet, the thinner sections occurring where the Omega formed the top of the bedrock and may have been partly removed by erosion.

Samples JM-4, JM-12, and JM-13 of the Omega Limestone are relatively high in carbonates (table 1). The conglomerate phase (sample JM-9) is much more siliceous and argillaceous and has a relatively high iron content.

Sampled outcrops are described in the appendix. Others are listed in table 2.

Limestones Above the Omega Limestone Member

Outcrops of limestone members above the Omega have been observed at two places in northeastern Marion County, in section 18, T. 3 N., R. 4 E., and in section 24, T. 4 N., R. 4 E. (fig. 3 and table 2). The outcrop in section 18 is exposed only as the top of a ledge in a public road and is a brown to red, fine-grained, silty, fossiliferous, rather soft limestone. The northeastern-most of the two is not now exposed but is described in field notes in Survey files as a single bed, 1 foot 2 inches thick, of gray, fine- to medium-grained, compact limestone. Its existence was confirmed by the farm owner.

Pleistocene Deposits

The surficial material overlying the bedrock in Jefferson and Marion Counties is chiefly glacial till, a pebbly clay that was deposited by one of the great glaciers that spread southward over Illinois many thousands of years ago. The maximum thickness observed was 15 feet but it is possibly much thicker in places.

RESOURCES BY COUNTIES

Jefferson County

The three major limestone units that crop out in Jefferson County are the Shoal Creek, Dix, and Omega Limestones. Although the Millersville Limestone, or its equivalent, supports quarrying operations in some parts of Illinois, in Jefferson County it appears to be too thin or too impure to be of interest.

TABLE 1 - CHEMICAL ANALYSES OF LIMESTONE SAMPLES FROM JEFFERSON AND MARION COUNTIES* S

(Analyses by Analytical Chemistry Section, Illinois State Geological Survey)

Sample	Limestone	T. R.	Sec.	Thick- ness (ft)	CaCO ₃ ⁺	MgCO ₃ ⁺	CaO	MgO	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	K ₂ O	CO ₂	C.C.E.
JEFFERSON COUNTY															
JM-1	Mattoon#	1S 2E	22	0.25											
JM-3	Mattoon#	2S 3E	19	2.50	73.9	1.80	41.4	0.72	14.1	3.3	2.29	0.18	0.64	33.70	84** 76.04
JM-10A	Dix	1S 2E	25	0.50											85**
JM-10B	Dix	1S 2E	25	4.00	62.1	12.00	34.8	4.80	16.6	2.30	3.78	0.20	0.56	34.57	76.38
JM-11	Dix	1S 2E	26	4.00	48.0	14.15	26.9	5.66	25.3	4.51	4.76	0.27	1.04	29.57	64.84
MARION COUNTY															
JM-4	Omega	3N 4E	9	4.00	93.6	2.65	52.4	1.06	2.25	0.5	1.74	tr	0.17	41.88	96.75
JM-5	Mattoon#	1N 1E	36	2.00	69.3	3.00	38.8	1.20	14.6	3.5	5.22	0.12	0.72	32.49	72.87
JM-6	Millersville	1N 1E	4	2.50	66.6	2.40	37.3	0.96	20.2	3.0	2.98	0.12	0.71	31.43	69.46
JM-7	Millersville	1N 1E	4	3.00	31.4	2.65	17.6	1.06	49.8	7.3	3.55	0.34	1.56	15.08	34.55
JM-8	Millersville	3N 1E	12	3.00	59.1	3.95	33.1	1.58	19.7	3.0	8.42 ^o	0.19	0.71	30.43	63.80
JM-9	Omega	3N 4E	18	3.00	62.5	1.50	35.0	0.60	19.2	4.0	6.88	0.15	0.66	34.52	64.29
JM-12	Omega	3N 3E	25	7.50	95.7	1.40	53.6	0.56	1.66	0.2	1.14	tr	0.09	42.71	97.37
JM-13	Omega	3N 4E	30	8.00	79.7	8.80	44.6	4.20	1.8	0.60	4.8	0.11	0.12	42.51	90.17
PERRY COUNTY															
JM-2	Shoal Creek	4S 1W	13	3.00	87.1	3.93	48.8	1.57	5.8	1.4	1.30	tr	0.34	40.00	91.78

* CO₂ by wet gravimetric analysis; other items by X-ray fluorescence.

+Calculated from CaO and MgO data.

#Formation in which the unnamed limestone occurs.

**Samples of beds with less than 2 feet exposed tested for calcium carbonate equivalent only. All other C.C.E. values calculated from CaCO₃ and MgCO₃.oSiderite (FeCO₃) identified in sample by X-ray

The Shoal Creek Limestone is not exposed in Jefferson County, but its outcrop along the Little Muddy River a quarter of a mile west of the Jefferson-Perry County line (sample site JM-2, fig. 3 and appendix) suggests that it might exist at quarryable depths in extreme western Jefferson County. Data from coal test borings suggest that the elevation of the Shoal Creek is as high for about 8 miles north as it is at the outcrop and may be close enough to the surface in places to quarry. More than 8 miles from the outcrop, however, it dips northward rapidly to a depth of 100 feet or more. The general eastward dip of the bedrock strata discourages prospecting for the Shoal Creek Limestone very far east of the western county line.

The Dix Limestone, quarried about 2 miles south of Dix, is the next higher unit that offers commercial possibilities. The four exposures of limestone in the small area south of Dix (two operating quarries, one abandoned quarry, and outcrop JM-10) probably all belong to this same unit. Its lithology and chemical composition vary (table 1, samples JM-10A, JM-10B, and JM-11), but it is apparently acceptable for, and is used as, roadstone. The outcrop thickness also varies, ranging from 4 feet in the Belle Rive quarry (sample JM-11) to 6 feet in the Randall quarry (table 2).

Virtually nothing is known of the persistence of this bed as a quarryable limestone outside the limited area of exposures. A structure contour map drawn on the top of the Herrin (No. 6) Coal (Siever, 1950) shows that these exposures are on a structural high and the beds dip to the south and east but retain essentially the same elevation to the north. Barring local changes in dip that are not reflected on the structure map, the limestone should remain at quarryable depth north of the exposures. However, the limestone may thin laterally and virtually disappear.

Siever's coal structure map and additional drilling information indicate that the outcrop belt of this limestone should lie in a general north-south direction. However, no outcrops of the unit have been recognized outside the present limited outcrop area, and no predictions can be made concerning its persistence.

The Omega Limestone is not known to crop out in Jefferson County. However, calculations based on elevations of the Shoal Creek in drill holes, as explained subsequently under Marion County, suggest that Omega Limestone should be present in northwestern Jefferson County in the vicinity of Bluford (fig. 3). The apparent lack of Omega outcrops in this vicinity may be due to any of several factors—the presence of glacial drift over the limestone, thinning of the limestone in this vicinity, or an error in the calculated elevation of 570 feet above the Shoal Creek.

Marion County

The only limestone units in Marion County that have commercial possibilities are the Omega and the Millersville. The Omega is being quarried at present in northeastern Marion County, but the Millersville is not known to have been commercially exploited. The Dix Limestone was not recognized in Marion County.

The Millersville is exposed in western Marion County. It was sampled at two localities (fig. 3) and was found to be a somewhat impure limestone about 3 feet thick (table 1, samples JM-6, JM-7, JM-8). Further tests

TABLE 2 - UNSAMPLED LIMESTONE EXPOSURES IN JEFFERSON AND MARION COUNTIES

T. R. Sec. Quarters	Near	Name of limestone	Thickness (ft)	Remarks
JEFFERSON COUNTY				
1S 2E 25 SW SW SW	Dix	Dix	1.00	Abandoned quarry; 5 feet of limestone exposed in 1939.
1S 2E 26 NE NW SE	Dix	Dix	6.00	Randall stone quarry.
1S 2E 30 SW SE NW	Dix	Mattoon*	1.50	West bank of creek.
2S 2E 6 NW SW SW	Woodlawn	Millersville (?)	1.00	Other outcrops of same bed reported in immediate vicinity.
3S 1E 5 NW NW NW	Woodlawn	Bond*	1.50	Ledge in creek bottom.
3S 1E 7 SE NE NE	Woodlawn	Bond*	1.00	Occurs as blocks nearly in place along stream.
3S 1E 16 SW NW NE	Woodlawn	Bond*	0.50	In ditch on east side of road.
3S 1E 35 SW SE SE	Waltonville	Mattoon*	0.75	Stream cut-bank 500 feet north of road.
4S 1E 13 SE SW SE	Waltonville	Millersville (?)	8.00	Lenses of limestone up to 4 feet thick and 10 feet long in shale.
4S 4E 35 NE NE SE	Belle Rive	Mattoon*	2.00	Limestone is very silty and shaly.
MARION COUNTY				
1N 4E 19 SW NW NE	Iuka	Mattoon*	1.00	In roadside ditch.
2N 3E 3 SW SE	Iuka	Omega	—	Float blocks of Omega Limestone along limited stretch of stream.
3N 4E 18 S½ SW SW	Iuka	Mattoon*	—	Top of limestone ledge in road.
3N 4E 19 NW SW SW	Kirmundy	Omega	3.00	Ledges in abandoned road.
3N 4E 30 NW NW	Iuka	Omega	3.00	Abandoned quarry in ravine.
4N 3E 16 NW SW NW	Kirmundy	Mattoon*	—	Blocks in field and ditch on east side of road.
4N 4E 24 NE SW NE	Kirmundy	Mattoon*	1.00	Data from field notes; not now exposed.
4N 4E 28 NW NW SW	Kirmundy	Omega	—	Blocks locally abundant on hillside east of road.
4N 4E 28 SE NE NE	Kirmundy	Omega	1.00	Limestone conglomerate in blocks along road and stream.

* Formation in which the unnamed limestone occurs.

of its thickness and quality could be made by drilling in the area between the two localities. The outcrop belt should not be expected to be a straight line, as differences in topography and local structural irregularities will cause deviations.

The Omega is the thickest and highest in carbonates of the limestones exposed in Marion County (table 1, samples JM-4, JM-12, and JM-13). Its conglomerate phase, represented by sample JM-9, is considerably less pure but is believed to compose a relatively small part of the Omega Limestone in Marion County. However, aside from the area of a few square miles between Iuka and Kinmundy where quarries, both active and abandoned, are located, the Omega crops out only rarely. Loose blocks of Omega found both southwest and northeast of the area of exposures suggest its presence beneath the drift but give little indication of its thickness (fig. 3).

The line on the map (fig. 3) representing the possible outcrop belt of the Omega is based, outside the known outcrop area, on Siever's (1950) coal structure map and elevations of the Shoal Creek taken from drilling records and is an approximation. The elevation of the Omega away from the outcrop area was calculated by adding to Shoal Creek elevations the interval 570 feet, the difference between the elevation of an Omega outcrop (sample JM-9) and the elevation of the Shoal Creek in a nearby drill hole. As this interval is likely to change from place to place, the actual elevation of the Omega at any given point could differ from the calculated elevation by as much as 50 feet. The Omega, therefore, could intersect the surface of the ground a considerable distance from the location of the outcrop line on the map. Particularly in the southeastern part of the county where there are no outcrops or drift blocks of Omega, the outcrop line should be used as a prospecting guide only to indicate the general area in which the Omega might reasonably be expected to occur.

REFERENCES

- Siever, Raymond, 1950, Structure of Herrin (No. 6) Coal bed in Marion and Fayette Counties and adjacent parts of Bond, Clinton, Montgomery, Clay, Effingham, Washington, Jefferson, and Wayne Counties: Illinois Geol. Survey Circ. 164, 100 p.
- Engelmann, Henry, 1868, Geology of Jefferson County, in Worthen, A. H., Geology and Palaeontology: Geol. Survey of Illinois, Vol. III, p. 220.

APPENDIX

SAMPLE SITES

Sample Site JM-1

Cen. $W\frac{1}{2}$ E $\frac{1}{2}$ sec. 22, T. 1 S., R. 2 E., Jefferson County, $1\frac{1}{2}$ miles south of Dix. Limestone in creek bed and higher strata in creek bank; 200 yards west of north-south road at T-junction.

	Thickness	
	(ft)	(in)
Covered	6	0
Siltstone	0	6
Covered	1	0
Limestone, brown, sublithographic; sample JM-1 (limestone in Mattoon Formation below Omega Limestone).	0	3

Sample Site JM-2

SW $\frac{1}{4}$ SE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 13, T. 4 S., R. 1 W., Perry County, 6 miles southwest of Waltonville. Cut-bank, east side of Little Muddy River.

	Thickness	
	(ft)	
Covered	5	
Limestone, grayish brown, sublithographic, slightly fossiliferous; sample JM-2 (Shoal Creek Limestone).	3	
Shale, black, fissile	$1\frac{1}{2}$	
Shale, gray	5	
Covered to water.	1	

Sample Site JM-3

NE $\frac{1}{4}$ NE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 19, T. 2 S., R. 3 E., Jefferson County, 1 mile north of Mt. Vernon. Cut-bank at south side of creek one-eighth of a mile east of Route 37.

	Thickness	
	(ft)	
Covered (appears to be mostly shale and sandstone).	10	
Limestone, black, fine, silty, fossiliferous; weathers very thin bedded; sample JM-3 (limestone in Mattoon Formation below Omega Limestone).	$2\frac{1}{2}$	
Covered to water.	2	

Sample Site JM-4

NW $\frac{1}{4}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 9, T. 3 N., R. 4 E., Marion County, 5 miles north of Iuka. Abandoned quarry; this and other Omega Limestone outcrops in the vicinity are now in Forbes State Park.

	Thickness (ft)
Covered (soil and silt)	5
Limestone, dark brownish gray, hard, dense, very fine, fossiliferous (Omega Limestone)	$\frac{1}{2}$
Limestone, brownish gray, very fine, hard, dense, some fossils (Omega Limestone). . .	3
Limestone, brownish gray, very fossiliferous; weathers very thin bedded (Omega Limestone)	$\frac{1}{2}$
Shale, gray; some sandstone, thin bedded. . .	4

Sample JM-4 from the three limestone beds totals 4 feet.

Sample Site JM-5

NE $\frac{1}{4}$ NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 36, T. 1 N., R. 1 E., Marion County, half a mile northeast of Walnut Hill. Limestone in floor of stream valley north of bridge; beds form crest of small anticline. Sandstone and shale in creek bank. Shale thickens rapidly in downstream direction due in part to small-scale faulting and squeezing.

	Thickness (ft)
Covered	1 to 3
Sandstone, light brown, fine, thin to medium bedded.	3
Shale, gray	3 to 5
Limestone, dark brown, fine, silty, very fossiliferous; weathers thin and shaly; largely dark red from weathering; sample JM-5 (limestone in Mattoon Formation below Omega Limestone).	2

Sample Site JM-6

NW $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 4, T. 1 N., R. 1 E., Marion County, 1 mile east of Central City. South bank of Crooked Creek.

	Thickness (ft in)
Covered	4 0
Limestone, dark brownish gray, silty, fossil- iferous; sample JM-6 (Millersville Lime- stone).	2 6
Shale, gray, interbedded with limestone, thin, dark, earthy.	2 0
Coal.	0 1
Shale, gray	0 3
Covered to water.	1 0

Sample Site JM-7

NW $\frac{1}{4}$ SW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 4, T. 1 N., R. 1 E., Marion County, 1 mile east of Central City. South bank of Crooked Creek, one-eighth of a mile west of sample site JM-6. Because of slight westward dip of strata, the limestone is estimated to be about 10 feet above limestone JM-6.

	Thickness (ft)
Covered	4
Siltstone, calcareous, gray, a little lighter than JM-6 and much more silty and argillaceous; grades to shale in lower 1 foot; very few fossils; sample JM-7 (Millersville Limestone).	3
Covered to water.	9

Sample Site JM-8

NE $\frac{1}{4}$ NW $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 12, T. 3 N., R. 1 E., Marion County, 3 miles southeast of Patoka. Cut-bank south side of Jims Creek.

	Thickness (ft)
Covered	5
Limestone, dark brownish gray, fine grained, fossiliferous; looks silty; weathers thin bedded; sample JM-8 (Millersville Limestone)	3
Shale, gray; nodules and streaks of limestone, fine grained, earthy.	2
Covered to water.	3

Sample Site JM-9

SW $\frac{1}{4}$ SE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 18, T. 3 N., R. 4 E., Marion County, 5 miles north of Iuka. Outcrop on north side of stream just east of north-south road.

	Thickness (ft)
Conglomerate, about 75% limestone pebbles, 25% chiefly shale pebbles; sample JM-9 (Omega Limestone)	3
Sandstone, massive to thin bedded	2
Shale, sandy; sandstone, thin bedded.	5

Sample Site JM-10

NW $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 25, T. 1 S., R. 2 E., Jefferson County, 1 $\frac{1}{2}$ miles south of Dix. Outcrop continuous in bed of stream for about 200 feet beginning 50 feet south of abandoned road. Type outcrop of Dix Limestone Member.

	Thickness (ft)
Covered	6
Shale, gray	2
Limestone, brownish gray, fine, massive, brittle; weathers yellowish brown; a few ostracodes and <u>Spirorbis</u> ; sample JM-10B (Dix Limestone)	4
Covered	2 \pm
Limestone, brownish gray, very fine to sub- lithographic, brittle, massive, slightly fossiliferous with ostracodes and <u>Spirorbis</u> ; sample JM-10A (Dix Limestone)	$\frac{1}{2}$

Sample Site JM-11

NW $\frac{1}{4}$ NE $\frac{1}{4}$ SE $\frac{1}{4}$ sec. 26, T. 1 S., R. 2 E., Jefferson County, 2 miles south of Dix. Quarry of Belle Rive Mining Company.

	Thickness (ft)
Overburden, till.	15
Limestone, dark gray, very fine, argillaceous; shale, dark gray, calcareous (Dix Limestone)	1
Limestone, light brownish gray, very fine, silty; changes to darker gray in lower 1 foot; massive; sample JM-11 (Dix Limestone)	4
Limestone, gray, very fine, finely fossilif- erous, silty; in floor (Dix Limestone)	

Sample JM-11 is from the 4-foot limestone bed.

Sample Site JM-12

NE $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 25, T. 3 N., R. 3 E., Marion County, 4 miles north of Iuka. Shoots quarry.

	Thickness (ft)
Silt.	1
Shale, gray	18 \pm
Limestone, light brownish gray, fine grained, massive, very fossiliferous; contains patches slightly darker gray and less fos- siliferous; sample JM-12 (Omega Limestone)	7 $\frac{1}{2}$
Shale, dark gray.	1
Shale in floor	

Sample Site JM-13

NW $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$ sec. 30, T. 3 N., R. 4 E., Marion County, 4 miles north of Iuka. Abandoned quarry just north of junction of Bee Branch and tributary from north.

	Thickness (ft)
Glacial drift	15
Shale and siltstone	5
Limestone, light brownish gray, medium grained, fossiliferous with many fusulinids, some bryozoans; weathers brown in patches (Omega Limestone).	3
Limestone, same as above but mottled light gray and light brownish gray; scattered large brachiopods (Omega Limestone)	5
Water	

Sample JM-13 from 2 limestone beds totals 8 feet.

